

COMMUNICATION HORIZONS

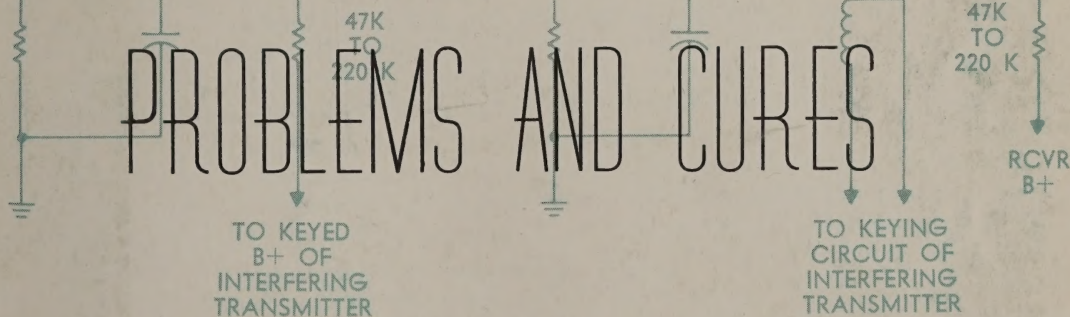
BASIC ANTI DESENSITIZATION CIRCUITRY

(A)

(B)

MULTI TRANSMITTER/RECEIVER
INSTALLATIONS—

PROBLEMS AND CURES



THE PROFESSIONAL COMMUNICATIONS MAGAZINE

FEATURED THIS MONTH

TWO SY-PEP PAPERS—
Multi-Transmitter-Receivers
15 Kc Tertiary Channels

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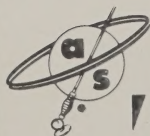
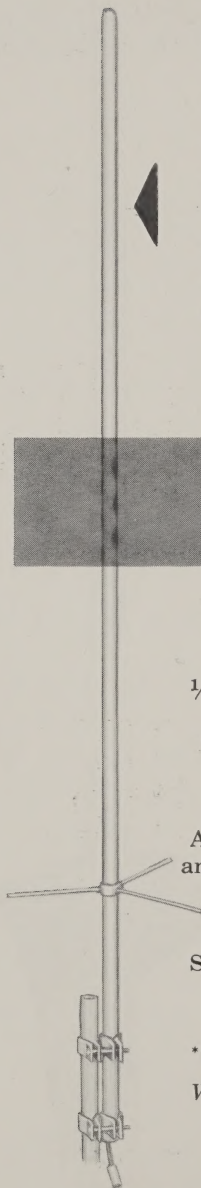
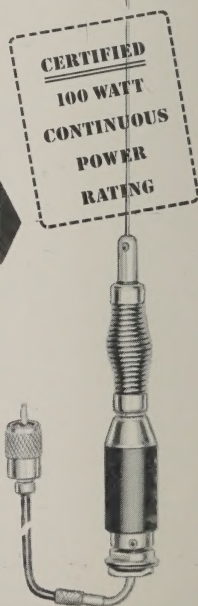
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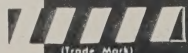
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SPLATTER



Editorial Notes from
Communication Horizons Editor

Robert B. Cooper, Jr., K6EDX

STRIKE WHILE THE IRON IS HOT!

Docket 14229 is now before the Federal Communications Commission. Here is what this Docket is and why *you* should be more concerned with this pending *possible change* than any Docket in the past history of communications.

Docket 14229 *does not* apply directly to two-way communications. But its side affects are literally boundless. The Docket in question concerns the FCC's decision to populate the near-vacant UHF television band with new A5 signals. The Docket concerns "de-intermixing" areas where both VHF and UHF television stations are now operating. Says the Commission, 'we now recognize that very high frequency and ultra high frequency television stations cannot operate in the same area on an equal economic footing.' To equalize the economic basis for television stations in any given region, the commission proposes to remove all existing VHF stations in 8 selected areas in the country where "intermixture" exists, and place these stations on UHF. This is the basis for Docket 14229.

Now . . . why should you be concerned for the fate of television allocations?

Simply because Docket 14229 also includes a remote possibility for re-allocating the un-used VHF television spectrum space to two-way communications. It is no particular secret that the Commission regards the growth of two-way communications dependent upon the eventual removal of all

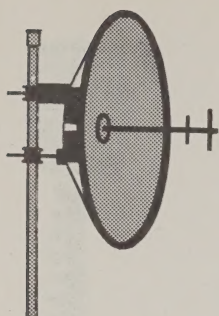
VHF television to UHF. *Now*, here at last is a concrete proposal to remove VHF television signals from the airwaves in such cities as Madison, Wisconsin; Rockford, Illinois; Hartford, Connecticut; Erie, Pennsylvania; Binghamton, New York; Champaign, Illinois; Columbia, South Carolina; and Montgomery, Alabama. VHF operation has already been removed from Fresno, California and is pending in Bakersfield, California.

On an un-official level, the Commission has proposed to add 34 two-way communications channels in each of these areas, *following* the removal of the VHF television stations. These 34 channels would occupy approximately one megacycle in one of the vacant VHF channels, in each of these 8 (or 9) metropolitan areas.

At the present time the future of Docket 14229 is clouded. As soon as it was announced the Commission was flooded with protests from Congressional representatives who staged a series of mass meetings in their home regions demanding that the Commission reconsider the proposal. There can be little doubt that the public reaction was inspired at least in part by the VHF station owners who fear moving to UHF like the plague. And why shouldn't they! At the present time they are sitting on one horse gold mines . . . operating on VHF in markets with one or more UHF competitors, accumulating the bulk of the advertising and underselling their UHF *competition* at every turn.

But all of this should be of secondary importance. The mere fact that only an eventual all UHF television system (com-

(Continued on page 28)



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8	R8	0.4	0.02	1,270
6	R6	0.4	0.02	714
4	R4	0.4	0.02	320
2	R2	0.4	0.02	75

*Including antenna

HEATED RADOMES

Dia. Feet	Type No.	Atten. @ 6 kmc. db	VSWR Contr. @ 6 kmc.	Thrust at* 30 psf (Flats), lbs.	Power** Reqmts.
10	HR10	0.7	0.02	1,990	3,400 W.
8	HR8	0.7	0.02	1,270	2,400 W.
6	HR6	0.7	0.02	714	1,200 W.
4	HR4	0.7	0.02	320	550 W.
2	HR2	0.7	0.02	75	150 W.

*Including antenna

**Power requirements for HR10 and HR8 are 3 wire single phase 60 cycle 220 volts. Power requirements for HR6, HR4 and HR2 are single phase 60 cycle 115 volts

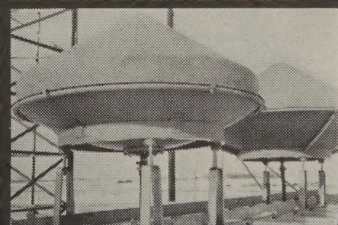
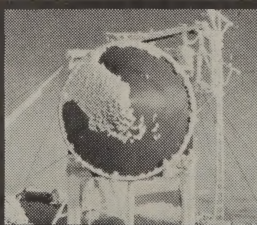
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MULTI TRANSMITTER-RECEIVER INSTALLATION INTERFERENCE PROBLEMS AND CURES

STUART F. MEYER

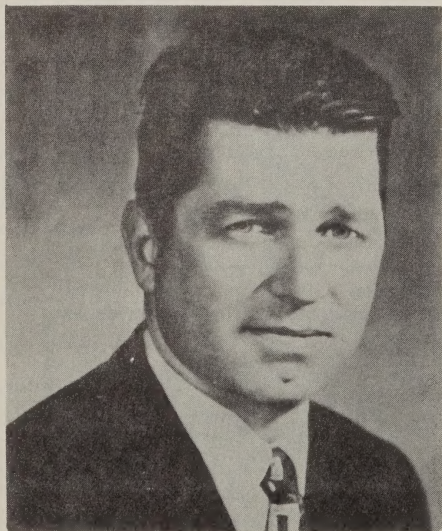
**The Hammarlund Mfg. Co.
New York, New York**

PART ONE

About the Author

The Hammarlund Manufacturing Company recently announced the appointment of Mr. Stuart Meyer as Vice President in Charge of Engineering. Mr. Meyer's expanded duties include supervision of new product development for the rapidly expanding design activities at Hammarlund, and Outercom Electronics, Inc. Outercom is affiliated with Hammarlund.

Mr. Meyer is a member of the Institute of Radio Engineers and has of late been extremely active in its Professional Group, Vehicular Communications. He is also active on a number of committees for the Electronics Industry Association.



Interference problems, between receivers and transmitters located at multiple base station sites, have grown by leaps and bounds because split channels have made

possible many additional two-way radio systems. Prior to the use of the present narrow band operation many interference problems went by unnoticed because the resultant spurious signals often fell between the channels in use at that time. Now the installation of a new system or systems on the split channels often results in a higher percentage of interference cases.

The organization or person responsible for the installation of two-way radio systems plays an extremely important part in this interference problem. Many problems can be minimized or completely eliminated by using some basic facts and some careful planning. Too many times in the past the so-called ideal base station location has turned out to be *anything but that* because system upon system was added until the final result was a hopeless mess. Very often this so-called ideal location would be picked for the first system with field tests being made basically on a single system basis, with little or no regard for any problems other than that of talking to the remote coverage points of the particular system. A second system may then be added with little or no planning and if it did not appear to interfere with the existing system or vice versa a third system was installed at the same site—and so on. In many cases insufficient tests were conducted as the subsequent system was put into service, and the individual users “all-of-a-sudden” found themselves plagued with

problems they thought did not or would not exist.

The types of interference encountered at such base station sites may be generally classified in three categories as follows; Nuisance interference, Harmful interference, and Unheard interference.

(1) Nuisance interference is that type which is heard on the "interfered-with" channel but is of sufficient signal intensity that it does not prevent the normal exchange of messages in a two-way radio system. This type of interference is very often covered up by the use of a tone squelch signaling system.

(2) Harmful interference is that type which is sufficiently strong in signal intensity that the handling of messages on the desired channel is seriously disrupted and in many cases completely impossible. While tone squelch might be used to cover up this type of interference, it does not cure the basic problem nor does it make the system usable.

(3) Unheard interference is that type which is not heard on the channel but does disrupt communications by virtue of the fact that the associated base station receiver is desensitized or paralyzed.

The various types of interference referenced above may result from one or more of the following:

Transmitter Side Band Noise

Transmitter Harmonics

*Transmitter Spurious Signals
(Other Than Harmonics)*

Receiver Spurious Responses

Receiver Desensitization/Intermodulation

Transmitter Intermodulation

Transmitter sideband noise is one of the limiting factors when attempting to work two radio systems having channel spacings in the order of one or two channels. For all practical purposes it may be said that adjacent or alternate channel systems with the receivers and transmitters located at a common base station site is impractical. A recent article appearing in *Communication Horizons* by Mr. John McCormick* goes into great detail on this subject and it is highly recommended that it be thoroughly studied.

*See July, August Issues - *Comm. Horizons*.

Harmonics of the Transmitter Carrier Frequency results in signals from transmitters in the 25-54 mc. band producing unwanted signals in the 144-174 mc. band or from transmitters in the 144-174 mc. band producing unwanted signals in the 450-470 mc. band. A not too uncommon case is that of the VHF taxi base station on 152.450 mc. emitting a third harmonic on a UHF taxi base station receiver frequency of 457.350 mc.

In running down the reason for transmitters producing these problems one must first determine if the interference is being radiated directly from the transmitter chassis and its associated wiring or from the antenna system. The simplest test here is to replace the transmitting antenna with a non-radiating dummy load and with a normal antenna on the associated receiver, re-run the interference tests. If the interference is absent it is safe to assume that additional filtering of the transmitter RF output will clean up the problem and in these instances the installation of a low pass filter with the proper cut-off frequency (in addition to the filter incorporated in the transmitter) is necessary. Many field engineers are surprised to find that the harmonic filter normally supplied in a production transmitter is insufficient to do the job at multi base station sites. One must realize that the FCC requirements calling for spurious radiation attenuation in the range of 50 to 80 db (depending on transmitter power) is based upon economics vs. the mathematical probability of interference in the field under most conditions. Most multi-transmitter/receiver sites require attenuation well in excess of 100 db to produce a workable system.

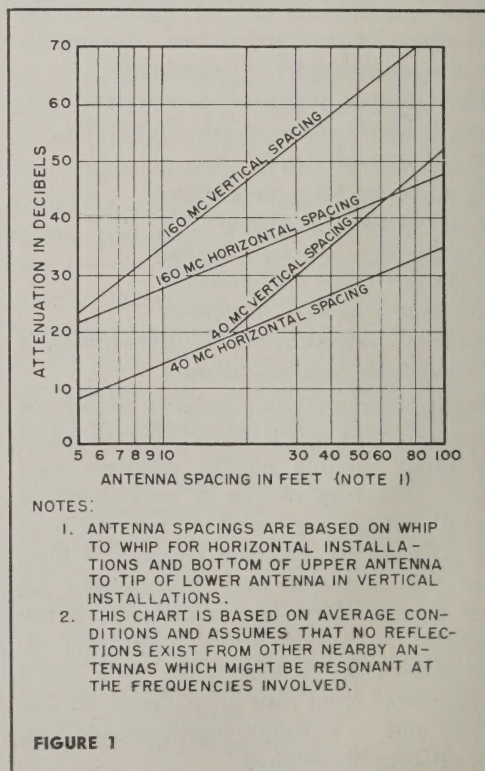
In the instance where the dummy load test reveals the presence of interference, shielding of the open rear chassis followed by proper by-passing of all the power and/or control leads may be required. Some good reference material is presented in the publication entitled "Television Interference Problems" by Philip S. Rand. This publication deals with amateur type transmitters; however, the fundamental problems are the same and his treatment of the subject is well done. Often it will be found that after curing the radiation from

the transmitter chassis, a problem still exists when the antenna is again reconnected. In these cases there is no out but to go through both steps. That is, first cure the interference radiated by the transmitter when terminated with a non-radiating dummy load and then go on to cure the problem when the antenna has been connected. In very stubborn cases it may be necessary to resort to a cavity resonator, although generally speaking this is only required in extreme cases of intermodulation as discussed later in this series.

Generally speaking, transmitter spurious signals (aside from harmonics of the carrier frequencies) consist of radiations which are multiples of the crystal frequency other than the desired. A typical example is a transmitter operating on 43.18 mc. in the industrial radio service with a multiplication factor of 16 times having a fourteenth harmonic of its crystal frequency of 2676.375 kc. or 37.78 mc. in the power service. In this case a cavity resonator could be used at the base station transmitter output to suppress this interference, although a $\frac{1}{4}$ wave open ended stub will provide at least 15 db of attenuation with less than 1 db loss at the operating frequency. Some years back a favorite trick was to change the transmitter multiplication factor (depending on transmitter design) thus moving the spurious radiation to another spot in the spectrum. However, more recent tightening of FCC rules concerning equipment type acceptance makes this an impractical solution unless one is in a position to submit extensive technical data based on measurements taken on a modified unit. As a

Transmitter intermodulation is caused by signals being present in the final stage of a transmitter other than those of the intended operating frequency. This is usually caused in multiple base station sites where transmitting antennas are mounted so close together that the radiated signal of one transmitter is picked up by another transmitting antenna, fed down the transmission line and appears in the plate and grid circuits of the final radio frequency stage of that unit. When this signal is of sufficient magnitude, beats equivalent to the sum and different frequencies of the spacing involved will be produced. For instance,

if the antenna of the two transmitters are mounted on the same tower or roof top—one operating on 45.6 mc. and the other operating on 45.7 mc., it is entirely possible that the 45.6 transmitter will also transmit a signal on 45.5 mc. when the 45.7 mc. transmitter is operating and the 45.7 mc. transmitter can produce an unwanted signal on 45.8 mc. when the 45.6 mc. transmitter is operating. In some cases the resulting spurious signal produced is sufficiently strong to be heard over an area of many square miles. As a general rule this situation is most pronounced when the transmitting antennas are mounted side by side. If at all possible the antennas should be mounted one over the other or at least staggered so as to minimize coupling. Figure 1 shows some typical values of attenuation between antennas when mounted vertically or co-linearly vs. side by side or horizontally. In stubborn cases it may be necessary to use cavity resonators in the output circuits of the transmitters in order to attenuate the undesired signals.



Part two in the January Communication Horizons

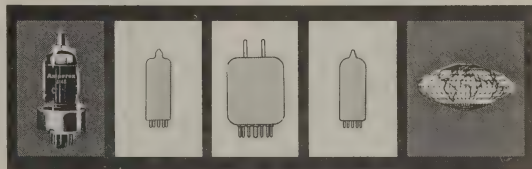
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THE USE OF THE 15 KC TERTIARY CHANNELS IN THE 150 MC BUSINESS RADIO SERVICE

Max A. Peckhart

**Communications Division
Motorola, Inc.
Chicago 51, Illinois**

About the Author

Max A. Peckhart is Assistant Chief Engineer, Systems Engineering Department, for Motorola Communications Products. A graduate of Purdue University, Peckhart was with the American Telephone and Telegraph Company prior to joining Motorola in 1951. He is active in the Institute of Radio Engineers, and the Professional Group on Vehicular Communications.



PROLOGUE

The demand for 150 mc. Business Radio Service channel assignments has resulted in severe congestion on the present 30 kc. spaced channels. The use of the 15 kc tertiary channels in this service has been suggested as a source of additional channels not requiring additional spectrum space. This paper points out that the present state of the art of equipment design is imposing limitations on operating radio systems in 15 kc. spaced channels in the same geographical area. The need for geographical separation between adjacent systems to prevent severe degradation of the service is discussed. The conclusion is reached that the 15 kc. channels can be used to relieve the present congestion effectively, only if proper geographical separation between the users is provided.

INTRODUCTION

In August, 1958, the FCC created the Business Radio Service. The rapid rate of growth of this service has resulted in the limited number of channels becoming extremely congested in many areas. The problem is particularly severe in the 150 mc. band. In February, 1961, the FCC proposed further "channel splitting" in the Business Radio Service, which would make available on a regular basis, thirteen (13) new 15 kc tertiary channels without requiring additional spectrum.

The purpose of this paper is to describe the limitations placed on system design by the use of 15 kc. spaced channels in the 150 mc. band.

The three basic considerations are:

1. Are the present narrow-band technical standards adequate for 15 kc. channel operation?
2. What limitations does the state of the art impose on this type of operation.
3. What limitations must be placed on the system design to gain maximum utilization of these new channels?

TECHNICAL STANDARDS

Transmitter

The present narrow-band technical standards require that the transmitter carrier frequency be maintained within $\pm .0005\%$ of its assigned frequency. This stability is adequate for 15 kc. channel spacing, but the necessity for maintaining transmitters within this tolerance becomes more critical. Transmitters that wander outside of this tolerance will not only degrade the operation of the system with which they are associated, but can also adversely affect adjacent channel users.

The present ± 5 kc. deviation is compatible with 15 kc. operation. The proper adjustment of the modulation limiters and modulation levels is very important to minimize modulation splatter into the adjacent channels.

The low-pass post limiter filters required by present standards are even more important with narrower channel spacing to reduce the modulation of the transmitter by voice harmonics above 3 kc, and thereby reduce the modulation splatter into the adjacent users' channels.

Present technical standards are adequate, but the transmitters must be maintained within the boundaries that these standards dictate.

Receivers

Receivers are commercially available today that have sufficient selectivity to enable them to operate on 15 kc. channels.

Therefore, the technical standards that govern the licensing of today's transmitters are adequate for 15 kc. channel operation, and the companion receivers are available. However, there is more to the story.

STATE OF THE ART

Modulation Sidebands

When an FM transmitter is modulated, modulation sidebands are produced and they spread on either side of the carrier frequency. Some of these sidebands fall within the pass band of the adjacent channels, 15 kc. away. The present known state

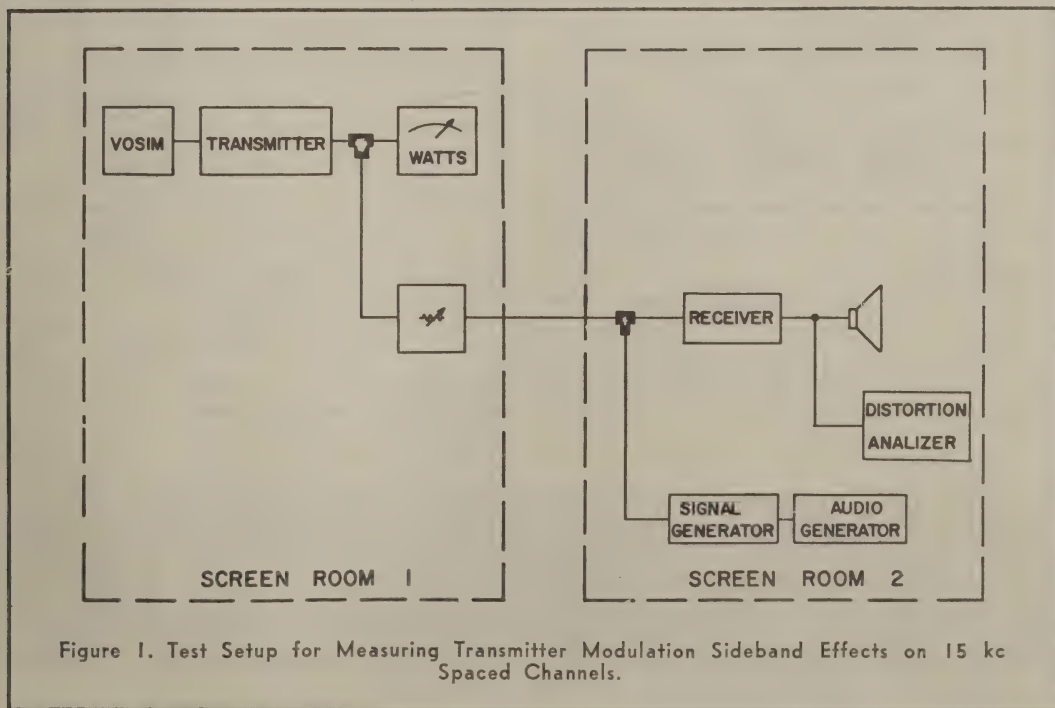


Figure 1. Test Setup for Measuring Transmitter Modulation Sideband Effects on 15 kc Spaced Channels.

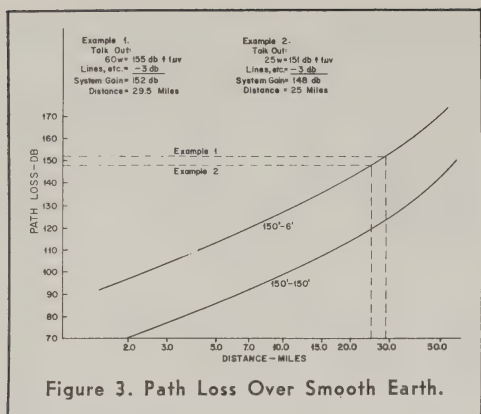


Figure 3. Path Loss Over Smooth Earth.

The talk-out range of this system (with no noise or interfering signals) will be about 29.5 miles, and the mobile should be able to talk back to its base station from anywhere within a radius of 25 miles. The usable two-way communications range, therefore, will be 25 miles.

Effects of the Undesired Transmitter

To complete the study of the hypothetical system, the data taken from the measurements made on actual equipment is combined with the system gains and propagation losses computed above. The undesired signal level required to produce 5 db reduction in the SINAD of audio recovered from the desired signal, is used in the following analysis since it represents the threshold of audible interference. First to be considered is the effect of talk-out range that the undesired base station has on the desired mobile, as its distance from the desired base station is varied. This effect is plotted in figure 4. The d^2 curve is

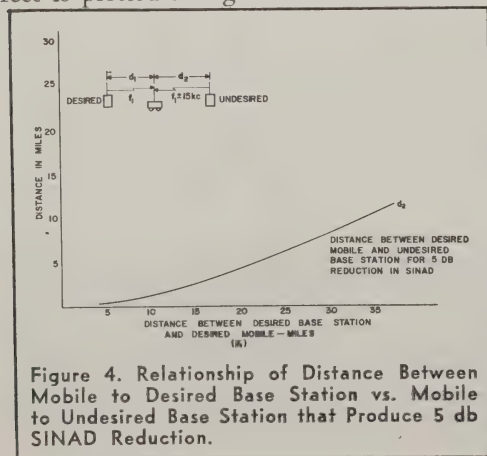


Figure 4. Relationship of Distance Between Mobile to Desired Base Station vs. Mobile to Undesired Base Station that Produce 5 db SINAD Reduction.

a plot of how close the desired mobile can approach the undesired station (when it is a distance d^1 from the desired base station) before the interference becomes audible when both base stations are transmitting. The closer it is to the desired base station, the closer it can be to the undesired base station, before audible interference results.

The effect of the interference on the desired base station talk-out range is plotted in Figure 5. The areas of interference around the undesired base station become larger as the separation between the base stations increase. The reduction in total talk-out coverage is small.

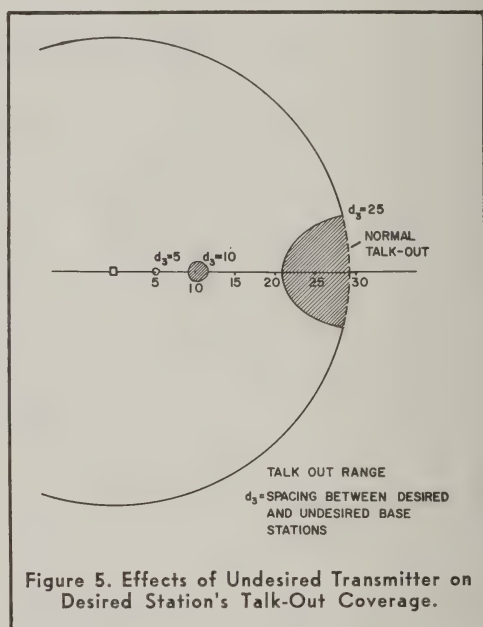
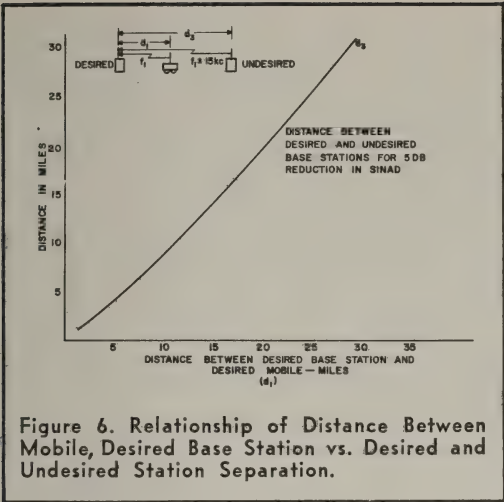


Figure 5. Effects of Undesired Transmitter on Desired Station's Talk-Out Coverage.

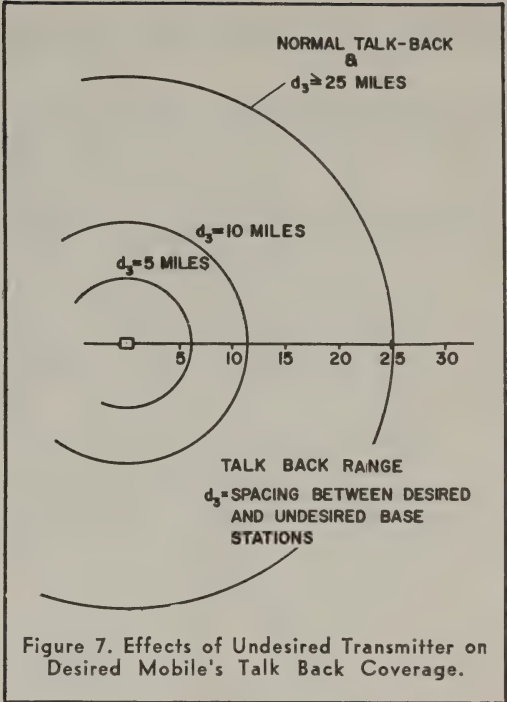
Next, the effect that the undesired base station has on the ability of the desired base station receiver to hear the mobile unit talk back is considered. This effect is plotted in Figure 6.

The d^3 curve is a plot of how close the undesired base station transmitter can approach the desired base station receiver (desired station) before the interference becomes audible when the undesired base station transmitter is on the air. The closer the spacing between the desired and undesired base stations, the closer the mobile



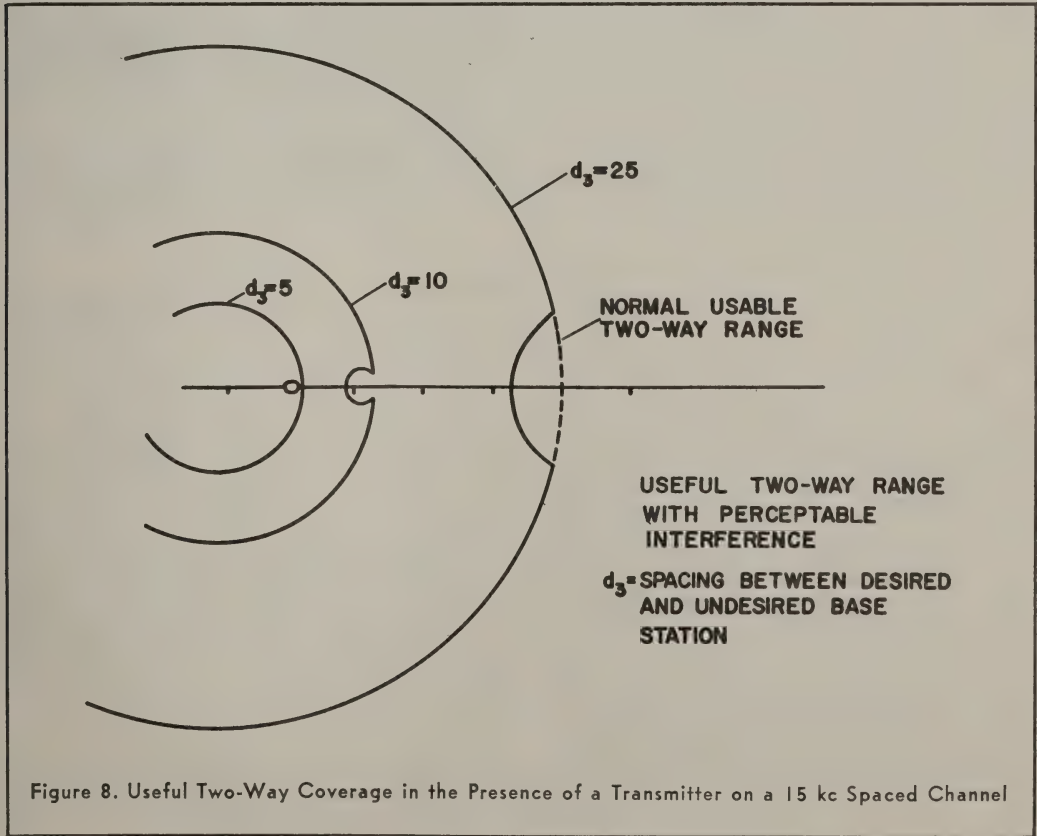
must be to the desired base station to be able to talk-back.

The resultant effects on coverage are shown in Figure 7. When the base stations are spaced 25 miles apart, the effects of the undesired base station does not significantly reduce the desired mobile's talk-back range. However, when the base stations are separated only 5 miles, the mobile's talk-back range is reduced from 25 miles to

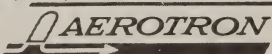


about 6 miles whenever the undesired base station transmitter is on the air. This is about 96% reduction in the area in which

(Continued on page 28)



service notes

FROM 

Congratulations to Mr. Donald Demarest of Charles W. Rogers & Son, Inc., Aerotron Sales & Service Agency of Manasquan, New Jersey for submitting the winning entry in Aerotron's "Service - Tip - of - The Month" column.

If you're a technician servicing Aerotron two-way communications equipment and have run across a timely bit of advice for other Aerotron servicemen, send a brief write-up about it to Aerotron, Department C-H, Post Office Box 6527, Raleigh, North Carolina. If your suggestion is used in this column, we'll send you \$10.

Mr. Demarest's tip provides an easy method of measuring the input power (in terms of total cathode current) to the final amplifier in 6N15/U Aerotron transmitter-receiver units. A 10-ohm, 5%, 1/2-watt resistor is inserted between the 6360 cathodes (pin 2 of V 205) and ground. The cathodes are bypassed with a 0.0015 mf. disc ceramic capacitor with very short leads. An insulated lead is connected between pin 2 of V 205 and pin 1 of J 401. With this arrangement, total cathode current may be read at pin 1 of J 401 with a voltmeter. Any accurate voltmeter with 1000 ohms-per-volt sensitivity

or greater will do. One volt measured here is equal to 100 ma. total cathode current through the 10-ohm resistor. The product of plate voltage in volts and cathode current in amperes (100 ma. = 0.1 amp) gives the input power to the amplifier within the limits usually required of such measurements.

Honorable mention goes to two Aerotron employees, Mr. Lyn Williams, who devised the circuit changes, and Mr. Cliff Barber of the Engineering Department, who brought the changes to light.

The gain of the speech amplifier in early Aerotron 6N10 models is higher than needed when the controlled-reluctance transistor microphone is used. When the vibrator in these sets is replaced with a TVR, switching transients sometimes appear in the modulated transmitter output as a result.

The cure? Simply eliminate the first, grounded-grid speech amplifier stage, V 103B. Ground all unused tube elements in V 103B, and change the input circuitry around the microphone jack and triode section of the 6BN8 to duplicate that of the present 6N15/U models.

If you lack diagrams, send \$1 and mention this issue of **Communication Horizons**. The dollar defrays the cost of a 6N15/U maintenance manual, and mentioning the name of the publication reminds us to include a schematic of the 6N10.



Dept. C-H, Post Office Box 6527
Raleigh, North Carolina

LOGBOOK

A calendar of important meetings and events in the field of communications.

As still another service to our readers, COMMUNICATION HORIZONS is inaugurating, in this issue, a continuing "DATE-LINE" box to give, at a glance, the scheduling of upcoming events of significance to the two-way radio field. We know we're falling short of the mark in our first attempt, since many organizations have not yet formally reported the dates of their 1962 annual meetings. As the dates become known, however, we would like to know them. CH Washington Chief Robert E. Tall will be handling this department, so just shoot him a note—at 1327 F St., N.W., Washington 4, D.C.—if we've neglected an already-established date in our first listing, or as you firm a time-table for a future event.

NOVEMBER

Nov. 30 - Dec. 1 — 12th National Conference of Institute of Radio Engineers' Professional Group on Vehicular Communications. Radisson Hotel. Minneapolis, Minn.

DECEMBER

December 1 — New petroleum radio service rule becomes effective allowing licensees to transmit, on a secondary basis, audio tones and impulses on mobile frequencies above 25 mc. for the automatic alarm of actual of impending equipment or apparatus failure.

December 11 — Present frequency coordination procedures for 42-50 and 150.8-162 megacycle "split channel" frequencies go out of effect for police, fire, highway maintenance, and forestry conservation services, permitting applicants to satisfy coordination requirements for these frequencies by obtaining letters of coordination from appropriate frequency advisory committees.

December 11 — FCC hearing on AT&T "Telepak" tariff scheduled to start.

JANUARY

January 3, 1962 — Comments due on FCC proposal to allocate 46.52, 46.54, 46.56, and 46.58 mc. (former scatter frequencies) to local government radio service.

**CONTENTS:
MORE VHF MOBILE RADIO POWER
AND COVERAGE THAN YOU'VE EVER
BEEN ABLE TO BUY**

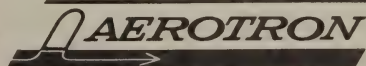


aerotron

slimline fm

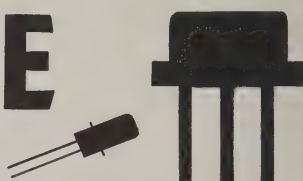
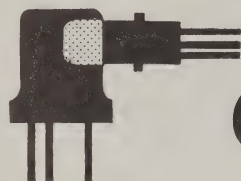
power package

FACT: The Slimline is the only 100-watt VHF Mobile Radio on the market. **PURPOSE:** Greater range from car to car—from car to base station . . . full saturation coverage of your entire area without dead spots. The Slimline power package (VHF or low band) is the only system that offers instant selection of normal output for short distance calls and full 100-watt output for long distance calls. **ADVANTAGE—**Keeps battery drain low. The stand-by power switch further reduces battery drain to less than that required for parking lights. Boost any 10-30 watt equipment to 100-watt output with amplifier alone. **PRICE:** including all standard accessories: VHF—\$595; low-band—\$615; amplifier only—\$250. For complete information, write today: (VHF-14B-174 MC)



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SOLID STATE



COMMUNICATIONS

Donald L. Stoner

**D. L. Stoner Associates
Alta Loma, California**

With this issue, *Communication Horizons* inaugurates a new department devoted to solid-state applications in the communications field. We at CH feel the name is particularly suitable. Transistors are usually thought of in connection with communications, however, there are many other semi-conductor devices which are equally useful in this field. Solid-state encompasses the entire array of semi-conductors and allied equipment.

Although Mr. Stoner is primarily known as a writer, his principal work is as a consultant and designer in the communications field, specializing in solid-state radio frequency equipment. His intimate knowledge of solid-state applications should prove useful to others working with semiconductor devices.

The Editor.

Undoubtedly the most popular solid-state equipment is the transistor power converter. Popular, at least, from the standpoint of widespread use. The freedom from moving parts, contact arcing and such, represents a great advantage over conventional vibrator and dynamotor converters.

Possibly the power converter is not as popular with those who must service and maintain the equipment. One often hears technicians discussing the problem of transistors shorting for no apparent reason. A two-way radio transceiver may work for months, or even years, then suddenly destroy the converter transistors.

The probable reason can be given in one word—transients. For one source, consider the tremendous voltages induced due to back emf of an automobile starter. When the starter, which contains a sizable inductance, breaks one-hundred amperes or so, a surge

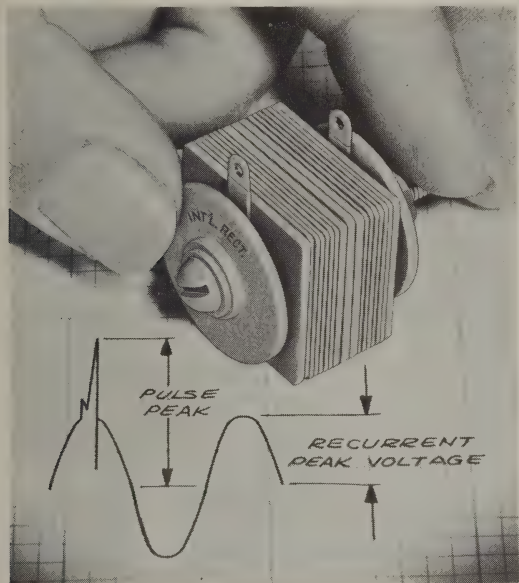
of high voltage is released into the ignition system. If coincidence should allow such a transient to occur at the peak of the converter switching cycle, the two can add and reach a potential which exceeds the transistor V-CE rating. The result is punchthrough of the transistor junction. More often than not, both switching transistors will be destroyed.

Good design dictates that the equipment be protected from transients of internal or external origin. Unfortunately, due to competitive economics or lack of engineering, suitable transient protection circuitry is often omitted.

There are several possible solutions to the transient problem. One device which should be included in any high reliability equipment is known under trade names such as General Electric "Thyrector" or International Rectifier "Klip-Sel". The principal of these semiconductor devices is the reverse breakdown characteristic, manufactured into the cell. The device conducts at a specific voltage instantaneously thereby clipping and dissipating transients at a known value which is well below breakdown rating of the transistors used in the equipment. The devices are available for any voltage between 25 and 500 volts and virtually any transient current rating, and are low in cost.

To protect the entire equipment, a 25 volt cell could be connected across the battery input. Any transient exceeding 25 volts causes the cell to reduce impedance radically, thereby clipping the destructive spike. The transient suppressor can also be connected between the active switching ele-

ments in the power converter (such as collector-to-collector or emitter-to-emitter depending on which element is common.) Connected in this manner the cell will also dissipate transients generated due to leakage reactance in the switching core.



International Rectified "Klip-Sel" will clip and dissipate transients which are otherwise destructive to mobile communications equipment.

Servicemen can easily install these clipping devices in troublesome equipment to increase reliability. The cost of these cells is in the three-dollar range, depending on device rating. This is considered inexpensive insurance against destruction of transistors costing six to ten dollars per pair. For more information on the "Thyrector", write General Electric Co., Rectifier Components Department, Carrol Avenue, Lynchburg, Va. and request bulletin 180.30 and 180.31. Data on the "Klip-Sel" is available by requesting bulletin SR-155 from International Rectifier Corporation, El Segundo, California.

Manufacturers would be wise to include these or similar devices in new equipment. Another trick for low cost transient suppression, which can be incorporated in new equipment, is the bootstrap clipper designed by the writer. In this circuit a tertiary winding having a few turns less than the switching winding is added to the core. This drives a full wave rectifier, with the out-

put connected to the supply line. The rectifiers are then back-biased by the supply. A transient which exceeds the switching waveform amplitude causes the rectifiers to conduct heavily, thereby dissipating and clipping the transient.

What's New?

Hoffman Electronics, El Monte, Calif, have recently annouced a tunnel diode with a peak current rating up to four amperes! These devices are priced as low as \$18.75.

The new Motorola "Meg-a-Life" series of power transistors in the industrial round package look like excellent devices for power converter applications. They carry V-CE ratings up 80 volts at 170 watt dissipation. For communication applications in r-f circuitry, the Motorola germanium epitaxial mesa transistors look superb. They feature a gain bandwidth products of 460 mc.



Texas Instruments new audio transistor features low noise and leakage current.

For low noise amplifier applications, investigate the Texas Instruments 2N929 and 2N930 which have a guaranteed noise figure of 4 db from 10 cycles to 10 kc. I-CEO of this new silicon planar devices is only 0.002 microamperes at 5 volts!

D.L.S.

PUBLIC SAFETY COMMUNICATIONS



Material Prepared and Submitted by

ROBERT E. BROOKING

Communications Engineer

City of Burbank, California

In the October issue of *Communication Horizons*, the subject of Conservation of the Radio Spectrum was discussed. Last month it was felt necessary to leave this subject, (or did we?) to discuss UHF-TV. In both articles, the dissenting statement of Commissioners Bartley and Lee was quoted. Subsequent events have proven their position to be correct. However, the complications referred to by Commissioners Bartley and Lee represent only a part of the picture.

What have the complications been, other than financial, in attempting to implement the split-channel Dockets? First, increased susceptibility to ignition and other interference caused by reduction of FM swing from 15 kc. to 5 kc. When Major Edwin Armstrong developed the system of Frequency Modulation he found a modulation index of 5 to be necessary for optimum quieting of interference. A higher index wasted space, a lower one sacrificed this most valuable asset of FM. Thus when FM broadcast standards were established, a peak index of 5 times a maximum frequency of 15,000 cycles produced the 100% modulation point of plus minus 75 kc. used in this service. By virtue of 3000 cycles being the highest frequency needed for good voice communication, the peak deviation of plus minus 15 kc. was established for the land mobile services. The value of FM for mobile communication had been proven conclusively in World War II. Thus a whole new concept in two-way mobile radio was created. Not only had the 30 to 50 mc. band worked well but 150 mc. looked like an ideal area for these services. These last frequencies were not bothered by skip interference either. Police and other Public

Safety agencies moved into this portion of the spectrum; others did too. Thus by 1954, a shortage of frequencies for the land mobile services was obvious and the Commission in 1955 came out with Docket 11253, previously mentioned.

As a result of the reduction of FM modulation to plus minus 5 kc., various Public Safety Radio Licensees found themselves in trouble due to a general loss of service area and increased difficulty from ignition interference. One of the obvious answers to the problem was to increase power. At the base station, this was simple but not so with the mobiles. The smart engineering approach to this problem has been to employ high gain base station antennas. This not only increases the Effective Radiated Power (ERP) of the transmitter but it also improves the reception of the mobile units by the same amount - provided interference at the receive point is not a factor. Obviously improved antenna performance will result in better reception of undesired signals too. The big problem though, is car to car coverage particularly simplex. Here, there has been a definite loss of service. Higher power is not practical and gain antennas at frequencies other than 450 mc. are out of the question. Many of the existing Public Safety systems are simplex. Every time one of these systems is converted to duplex because of this problem, we have defeated the very purpose of channel splitting.

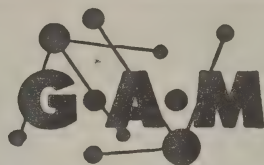
Another problem facing users in the 30-50 mc. band has been the increased susceptibility to ignition interference in the mobile unit. While ignition shielding will solve problems created by the engine of the car with the radio, it will do nothing about eliminating interference from other cars. Thus we have recently seen development of electronic devices to eliminate this interference; devices such as the Motorola Extender and the Hallet Message Master.

The idea of noise silencers is not new. J.J. Lamb developed a most effective one more than 25 years ago. The big point is that with FM, the need for such devices was eliminated. FM represented a step forward; it made mobile communication reliable and practical. Now in the name of spectrum conservation, we have a hybrid version of FM robbed of its most important asset, the ability to deliver an intelligible signal through interference.

But wait - an FM receiver must have a passband wide enough to accept the peak deviation of the frequency modulated signals; in this case plus minus 5 kc. In addition there must be an allowance for the carrier frequency tolerance and also that of the injection frequency of the super-hetrodyne receiver. At 160 mc. a transmitter may be off frequency nearly 800 cycles and still be legal at .0005%. Worse yet, what about the receiver? One manufacturer tells us heated crystals are not necessary. Others use Butler type oscillator circuits which have no means to "zero in" the receiver crystal. One manufacturer uses a filter which passes plus minus six kilocycles at the 6 db points; another uses a filter with seven kilocycles. Well, you add it up. Perhaps those complaints you have been getting about the voice "breaking up" on that new "narrow-band" equipment will now appear logical. The answer? Wider filters or crystals with closer tolerance. Maybe we would be better off back on AM. At least in AM, if the carrier and either side-band get through the filter, the signal will be intelligible. We don't need both side bands to get the message.

We have come up with a new term around the Communications Department in Burbank and it applies to receiver alignment. The term is "convergence," and it indicates the condition that exists when a transmitted carrier which the frequency standard indicates is precisely on frequency comes through the center of the receive filter (call it 455 kc.) and shows exact center on the discriminator. To accomplish this, all crystals must either be exactly on frequency or balance out to that same quantity. Oh yes, how is your .0005% stability doing?

R.E.B.



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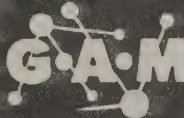
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OUR MAN IN WASHINGTON



Manager of Communication Horizons'
Washington Office, Robert E. Tall, reports on
the past month's communication activities

With interest so high on the subject of re-allocating "regional VHF television space" to the two-way communications user, Communication Horizons sent Washington Bureau Chief Robert E. Tall to New York City on November 10th to cover an address by FCC Commissioner Robert E. Lee, as the Commissioner appeared before the Manufacturers Radio Service there.

The text of the Commissioner's speech follows.

REMARKS OF COMMISSIONER ROBERT E. LEE

I like to speak when I can discuss an idea that is feasible, workable, and beneficial. Too long the non-broadcast segment of radio users has been treated as a step child.

Remember that the reason for this is one that lies not only on the front steps of the Federal Communications Commission but also is shared by the lack of realization on the part of industry as to the potential use of radio. For contrary to some thinking, the staff and members of the Commission are actively engaged in studying the problems of non-broadcast users and are moving toward solutions of their problems.

The Commission made a gigantic step in this direction in its Report and Order, Docket No. 11991 released June 23, 1958, which became effective August 1, 1958. In this Report and Order the Commission made various changes in the spectrum space and most important to you users in industry, created a new business service and carved out of the small segment of spectrum space available, a place for the Manufacturers Radio Service.

The creation of the Manufacturers Radio Service by the Federal Communications Commission was due in a major part to the efforts of the Committee on Manufacturers Radio Use of the National Association of Manufacturers, which furnished the Commission and the staff with the basic information of the need for such a service.

We did not stop there. In the months that followed we made adjustments, advantageous to you, in the rules initially adopted and we are right at this moment considering other changes.

I realize that not only does radio help you in the jobs you are doing but it will open the door for you to do different jobs, bigger ones, better ones.

No one needs to tell *you* that the growth, stability, and well being of our nation depends upon the foundation of industry in this country, but I thought it would be gratifying for you to know that there are those in your government who are deeply aware of this fact.

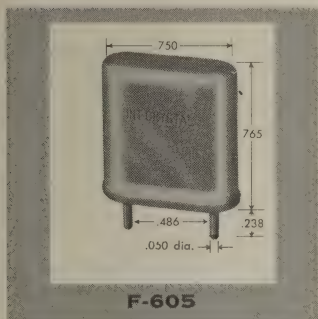
I feel this way and I'm going to do my best to see that something is done. Not as a reward but in a desire to see that government acts in the public interest to help and encourage those who are working to keep this nation alive at a time when it is beset by destructive ideologies all around the globe.

Now I'm not here to "soft soap" you with a lot of platitudes and cliches that you often hear from the featured speaker whose aim is to give his listeners a sense of well being and good fellowship so they won't go home and fire half their employees or give up their business.

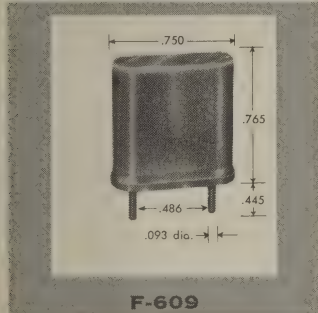
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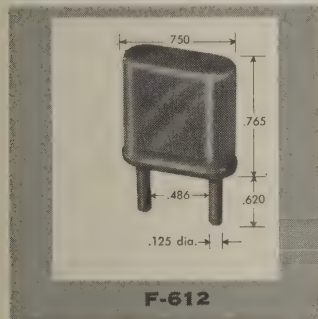
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FREQUENCIES 70 KC TO 137 MC

DESCRIPTION AND DATA:

All of these crystals are of the plated, wire-mounted type. Low drift AT-cut blanks are used in these units above 500 KC, and low drift DT and CT-cut blanks are used in units below 500 KC; any crystal can be supplied for operation with or without an oven.

TEMPERATURE TOLERANCE:

AT— $\pm .005\%$ from -55° to $+90^{\circ}\text{C.}$
 $\pm .002\%$ from -30° to $+60^{\circ}\text{C.}$
DT-CT— $\pm .01\%$ from -40° to $+70^{\circ}\text{C.}$

CALIBRATION TOLERANCE:

Supplied to meet equipment manufacturers specifications and may be as close as .001% without oven or .005% with oven. Where no equipment is specified the following will apply.

AT— $.0025\%$ of nominal at $+30^{\circ}\text{C.}$
DT-CT— $.01\%$ of nominal at $+30^{\circ}\text{C.}$

DRIVE LEVELS:

Maximum, AT—
10 milliwatts 500 KC to 999 KC
4 milliwatts 10,000 KC to 24,000 KC
2 milliwatts 25 MC to 137 MC
DT-CT—2 milliwatts

CIRCUIT: As specified by customer. Crystals are available for all major two-way equipment and in most cases the necessary correlation data is on file. Where circuit is not specified, the crystal will be calibrated for operation into a load capacitance of 32 mmf.

FREQUENCY RANGES AND MODES OF OPERATION

200-500 KC:

Operates on fundamental edge shear oscillation. Load capacitance 32 mmf or as specified by customer. If load is not known specify circuit or equipment in which crystal will be used.

500-20,000 KC:

Operates on fundamental face shear oscillation. Load capacitance 32 mmf or as specified by customer.

10-60 MC:

Operates on third mechanical overtone at anti-resonance. Will give reasonable output in tuned circuit.

60-100 MC:

Operates on fifth (or seventh) mechanical overtone at series-resonance. Drive level must be kept below 2 milliwatts.

ONE DAY SERVICE

Orders for less than five crystals are shipped within one working day following receipt of order (except low frequency and special crystals which require 10 to 30 days for processing). Orders received on Mon. thru Thurs. will be shipped the day following. Orders received on Fri. will be shipped the following Mon. Postage is prepaid within continental U.S. when cash accompanies order. All others are shipped F.O.B. Oklahoma City.

SUPPLY THIS INFORMATION WHEN ORDERING

MOTOROLA: Crystals can only be properly correlated for Motorola equipment if the crystal type number is given. Example: D02, R28, D03, etc. In cases where crystals are required for type D-14, 800 and 801 holders, always specify crystal frequency or the high IF frequency. Check whether the crystals are to be used in ovens.

GENERAL ELECTRIC: Specify model number of transmitter and receiver RF Decks. Example: 4ES13A3, 4ER24B1, 4ET5B3, etc. When ordering crystals for 450 MC equipment specify:

Receiver Crystals:

- A. If they are heated or non-heated.
- B. If the unit is AFC or NON-AFC Controlled.
- C. Platter number of present receiver deck.

Transmitter Crystals:

- A. If they are heated or non-heated.

R.C.A.: Specify model number of unit or MI Number of the crystal. Always indicate whether crystals are to be non-heated or heated type.

OTHERS: Specify model number of the receiver and transmitter as well as any formulae that pertain to the correct crystal calculation.

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850 - 899*	13.50	6000 - 9499	4.50	45 - 60	8.50
900 - 999*	12.50	9500 - 10999	5.00	61 - 75	10.50
1000 - 1499†	9.80	11000 - 14999	6.30	76 - 137	15.00
1500 - 1999†	7.50	15000 - 20000	8.00		
2000 - 1999	6.50				

*Allow 10 to 30 days for processing.

†Allow 2 to 3 days for processing.



18 NORTH LEE • OKLAHOMA CITY, OKLA.

I'm here to discuss a business-like proposal that will permit you to expand through the further use of radio.

The Commission has for a number of years been closely scrutinizing the growth of the Land Mobile Services and particularly those in Safety and Special Radio Services. Because they include practically all types of radio stations, except those used for broadcast and other specialized purposes, such as international fixed, amateur, business, industrial, marine and aviation activities, the Land Mobile Services constitute the largest and fastest growing group of radio users under our jurisdiction.

Our annual Report for 1961 will indicate that the total number of stations in the Safety and Special Services rose to 770,500 in 1961. This represents an increase of some 118,000 stations over the figure for the preceding year. In terms of authorized transmitters, 1961 saw the addition of a new half million, raising the grand total to something on the order of 2,700,000. No leveling off in the demand for these radio facilities is foreseen, rather, the converse is apparent.

The most significant aspect of the phenomenal growth that has taken place is the fact that this growth has occurred in an exceedingly small portion of the radio spectrum. But as you well know, "stacking", congestion, and mutually destructive interference in many areas of the country today are the rule rather than the exception; and as these problems compound, the over-all utility of the channels presently allocated, diminishes on something of the order of a geometric regression.

The Commission has maintained an incessant study of methods or means whereby a more effective utilization of the limited spectrum space at our disposal might be realized. Our efforts have resulted in a regulatory program involving tighter technical standards, narrower channel spacing, and other devices which have in small measure alleviated our problems in some respects. But while all of these refinements in spectrum utilization, and improved equipment, and more judicious operating methods, have their merits, they are necessarily self limiting in the sense that they

are applicable only to the already sparse number of frequencies presently available.

We are, from day to day, coping with the problem of accommodating present users in the Safety and Special Services. As this problem is difficult, the problem of accommodating normal future expansion and new users within the services promises to be even more difficult. Satisfaction of future frequency needs is a problem of paramount importance. We have no reason to believe that any diminishment in the use of radio will result in the near future. On the contrary, the expectation is that it will increase. This is emphasized when consideration is given to the many new uses for radio that are constantly being developed. To mention but a few, there are medical and biological telemetering, tone actuated point-to-point alarm and control functions, telemetering in hazardous industries, short range wireless microphone operations. These uses are not presently provided for in frequency allocations. They must, in the near future, be considered if radio is to serve the broad public welfare.

It is my considered judgment that any further solutions to the problems that beset the Commission in the non-broadcast services must not be premised solely upon further compression within the framework of the present non-broadcast frequency picture. I have looked elsewhere for spectrum vacancies to alleviate these problems and focused attention upon the unused channels of the VHF television bands.

In addition to those channels which are unapplied for, there are, or will be, certain VHF TV channels which will or have been withdrawn from certain areas. For example, our recent decisions to "de-intermix" Bakersfield and Fresno, California, will place these cities in the category of withdrawn assignments.

Of current interest is the Commission's July 28th announcement that it would delete the single VHF television channel in each of the following 8 cities: Montgomery, Alabama; Hartford, Connecticut; Champaign and Rockford, Illinois; Binghamton, New York; Erie, Pennsylvania; Columbia, South Carolina; and Madison, Wisconsin.

I am proposing to the Commission that

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we make portions of the "withdrawn" as well as the "unapplied for" television assignments available to the non-broadcast services for use in the areas from which the channels are proposed to be withdrawn. I am assuming that the term "public interest" is not reserved for the broadcast services. I propose to do this by placing on the Commission agenda an appropriate rule making to accomplish this purpose.

I stated that this would be done under certain prescribed conditions. First, only a 1 megacycle (approximately) portion would be extracted from each television channel band. This one megacycle would be taken from the approximate center of the band in order to afford maximum protection to the video and audio carrier frequencies of television stations operating in the same band. I would break down the extracted one megacycle into 34 channels or frequencies spaced at $31\frac{1}{2}$ kilocycle intervals. Considering some 50 unassigned VHF frequencies, plus the 8 deintermixed markets, some 2,000 frequencies would be immediately

available for non-broadcast use. Only Base Stations would be authorized to transmit on these frequencies. Operation would only be permitted at distances of 150 miles or more from television stations operating in the same channel. Antenna heights would be limited to 200 feet above average terrain; and power would be authorized to a maximum of 600 watts input. Associated Mobile units would be required to transmit on regular Land Mobile Service frequencies.

An interesting sidelight to operation in the manner that I have proposed is the fact that more protection would be provided to TV stations now operating than is presently afforded by co-channel TV stations.

In proposing the use of television channels for mobile radio uses, I am not unmindful of the needs of common carriers for more frequency space. The growth of the Domestic Public Land Mobile Service in certain populous areas has been impeded by the lack of sufficient frequencies to accommodate all the needs for new facilities.

(Continued on page 27)



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CASE HISTORY

KAAR'S NEW 450 MC / s EQUIPMENT

(Editor's note: Communication Horizons Publisher Bob Cooper is ever on the prowl for new products and services destined to outmode or improve upon existing equipment-services in the field. Recently the people at Kaar Engineering, Palo Alto, California advised Cooper of a forthcoming 450 MC unit which apparently transcends the old 'bug-a-boos' of two-way operation in this 'ultra-high frequency' band. His report follows.)

What Is The TR505/TR506?

When KAAR Engineering set forth to bring upon the two-way communications world a new concept in mobile and fixed 450-470 megacycle stations, they realized the task would not be an easy one. Were it such, it would have been an accomplished fact many months, or even years ago.

While low band and 150 mc. units have progressed at a steady engineering rate from nearly a dozen manufacturers, little attention has been shown of late to the nearly virgin 450 mc. region. The KAAR thinking behind the project is neither novel or new; it is current and timely. KAAR felt as many manufacturers do. The 150 mc. region has been split until it can virtually be split no more. The low band region is fast emptying of many classes of commercial users as government and military stations flex their occupancy muscles. With the need for additional two-way communication channels growing by the day, the move would soon be upward-frequency wise-and very shortly too.

Design Problems

The KAAR TR505/506 Radiotelephones represent the first products in KAAR's broad new UHF development program which will shortly offer a very complete line of two-way equipment in the 450-470 mc. range.

To research our story we went to KAAR's chief design engineer Ben Wright, directly responsible for the development of the TR505/506 series units. Wright is as proud of his new UHF series as a father must be of a newborn son. Piece by piece we went over its design, its component parts and its circuitry. Using blackboard and schematic Wright explained the inner workings of the new gear to our reporting staff.

"The secret of the transmitter portion of the rig is its new Amperex 7377 final amplifier. The tube itself is not terribly new, except here in the United States. In fact up until the WESCON Show in August we were planning to use the older Amperex 6939 dual tetrode which has been around since '57.

At the WESCON Show however we ran into the Amperex people who told us about the 7377, a brand new type of dual tetrode which appeared to be more symmetrical than the older 6939. Naturally we were interested. We wanted 10 watts output from our unit and the 7377 appeared to fill the bill. Its leads are shorter and its replacement cost is around \$14.00. The tube was being utilized in Europe for 960 megacycle link circuits, so we felt it would work very well in 450 mobile and fixed operation here in the states. The tube is rugged and has only one *manufacturing* drawback . . . its exceedingly strange base-pin configuration."

As Wright sketched the unit for us on his blackboard we glanced over the specs. Covering the 450-470 megacycle range, the TR505/506 operates from 6, 12 or 115 volts.



Kaar Engineer Ben Wright spent 90 minutes pouring over the TR505/506 schematic (on table) and a proto-type of the unit. The unusual Amperex 7377 is about to be 'socketed' in Wright's left hand.

The power supply is transistorized. The TR505 is under-dash mounting while the TR506 is trunk mounted with a separate control head assembly.

The unit meets FCC Type Acceptance under Parts 10, 11, 16, 19 (Class A) and 21.

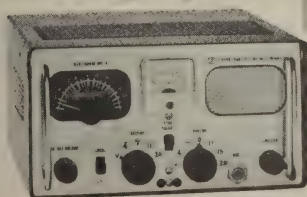
Frequency control on the transmitter is through .0005% crystals operating in a temperature controlled oven.



Mountain top repeater ala KAAR. Ben Wright's hand points out the time delay circuit which allows up to several seconds "lock-on" should the mobile tripping the repeater receiver drop into a dead spot. Note unique fold-down chassis with nylon retention cords for quick-easy servicing.

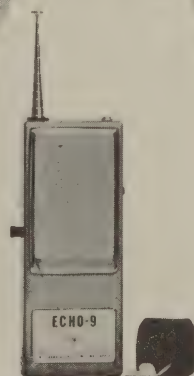
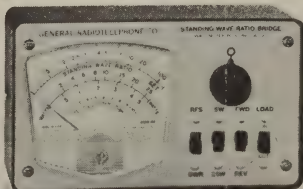
As we glanced up Wright was going into the design of the receiver. "We found we could obtain a minimum of 20 db quieting with 1.0 microvolt input with a single grounded grid 6AM4. The 6AM4 provides just enough gain to overcome the circuit losses in the tuned lines which really are the secret of the receiver. As you can see on the board we tap into the first tuned

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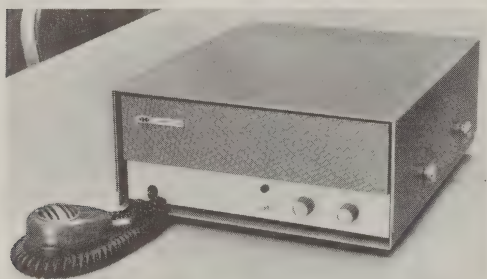
Under present rules part 19.32 the FCC does not provide for more than (5) watt input in the Citizens Radio Service (26.965 — 27.225 MC Band).

line cavity with the antenna, capacity couple to a second one and then into the cathode of the 6AM4. Two more tuned line cavities carry the signal into the 1N82A diode."

Here we interrupted Ben Wright with a question. "Why the 1N82A?"

"Simple enough" he replied. "This is not an exotic diode. It is a good general purpose UHF diode which is capable of fairly low noise mixing performance and a lot of knocking about."

The set uses 2 stages of 21 mc. amplification followed by the second conversion to 1500 kc. for bandpass shaping and filtering.

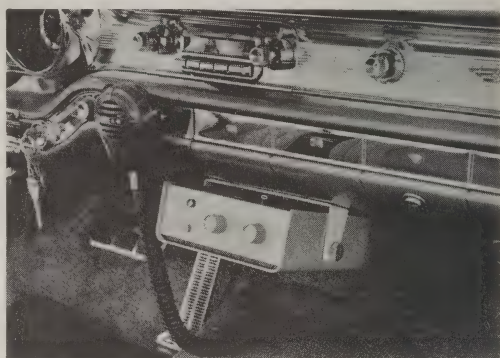


KAAR TR505 10 watt output 450-470 megacycle two-way radiotelephone.

"We had a little trouble lining up a proper filter for the 1500 kc. stage. We finally found that Wells Electronics Company in South Bend, Indiana could build the unit we need, which provides a bandpass as shown in diagram two. Notice in diagram two we have a 17 kc. i.f. bandpass. Of course the deviation is plus or minus 15 at maximum. The 2 kc. extra bandpass compensates for the .0005% drift which amounts to nearly 2 kc. at 450 megacycles. The 1500 kc. i.f. filter affords 80 db i.f. protection for adjacent channels, and there is no noticeable modulation splatter from adjacent channels."

Having amassed a notebook full of engineering data from Ben Wright we dropped in on Frank Genochio, Vice President in charge of sales at KAAR. Having learned what the TR505/506 series consists of, we wanted to quiz Frank on its expected field uses.

"The old TR500 series was originally designed for Class B service" he pointed out. "Existing 450 equipment falls into two categories, the very low power and the considerably higher power (250 watts and up).



KAAR TR506 remote control box, under dash mounted, includes squelch, volume controls, and speaker. Truly miniature in size and good looking too.

The TR505/506 package affords the user a choice of under dash or trunk mounting for just over \$500. per installation. With the announcement of the TR505/506 comes a companion announcement on a new UHF RF amplifier, the 8298 series unit. With the availability of this power amplifier, the user can boost his output into the 30-35 watt region. The amplifier unit can be used for a variety of services, including base station and repeater installations. The 8298 can be driven with the older model TR500 series sets, or any of the RCA, Dumont, General Electric, etc. sets which develop at least 4 watts output. The 8298 series utilizes an AX9903/5894 tube. The complete amplifier package sells for under \$300.00, and can be rack mounted (19 inch rack) or cabinet mounted."

Wishing Engineer Ben Wright and Vice President Frank Genochio a world of success with their new products, we wound our way out of the KAAR offices at 2995 Middlefield Road, Palo Alto (California) assured that the move to the 450 megacycle band would be met at least in part by the advancing engineering at KAAR Engineering.

R.B.C.

OUR MAN IN WASHINGTON

(Continued from page 23)

With the approach of November 1, 1963, by which time all 152/158 facilities will be required to operate on narrower radio channels, numerous stations in this service already have voluntarily converted to narrow band split channel operation in order to make additional channels available immediately. However, no further relief in congested areas is anticipated in the foreseeable future unless new frequencies are to be made available.

Moreover, there appears to be a pressing need for frequencies to accommodate air-to-ground telephone service. Since I recognize that this service when fully implemented would require a wide band exclusive frequency allocation, I propose to restrict the use of Safety and Special Radio Services to television channels 2 through 8 and to reserve channels 9 through 13 for possible future use by common carriers. A move of all of television broadcasting to UHF would open these frequencies to much needed and efficient uses by common carriers.

It should also be obvious that by providing new bands of frequencies for these non-broadcast services, the congestion in other bands can be greatly relieved.

I mentioned earlier that the Commission had proposed to delete the VHF channels in 8 single channel television markets. I do not wish to sound like a salesman for the National Geographic Magazine, but let me say there are many public interest considerations in these 8 cities to demonstrate a real need for at least a portion of the deleted frequencies for non-broadcast purposes.

There is not, I daresay, one single category of non-broadcast radio users, which couldn't either now or in the near future use an additional frequency or frequencies in the areas that I have mentioned. There are state and county governments with their police and fire protection arms to be considered; manufacturers in abundance; farmers, foresters, truckers, the railroads, miners, and heavy construction outfits; not to mention the multitudinous service indus-

tries, like the gas and electric utilities, and the telephone companies, which must also be kept in mind. There is finally that almost infinite category of users composed of retailers, wholesalers, jobbers, and persons "engaged in a commercial activity", who would stand to gain much by the adoption of the proposal I have outlined.

I suspect the VHF television station licensee could be greatly concerned by my proposal. However, I see no need for any apprehension. First, if the Commission can relieve the crowded situation in mobile services by the means I have suggested, the immediate need to send all of television broadcasting to UHF is to this extent lessened but by no means removed. The largest outstanding unsatisfied demand would then be for a broad-band exclusive frequency allocation for common carriers. Second, if non-broadcast services are fitted into this portion of the spectrum the likelihood of any appreciable channel shifting to satisfy television requirements would be significantly lessened. Certainly, from the standpoint of the broadcaster, it should be far preferable to share a channel with low power radio devices than with high power television stations at standard or sub-standard spacings.

In closing, I would like to acknowledge the assistance of Mr. Curtis Plummer, Chief of the Safety and Special Radio Services Bureau, and his competent staff for the details of the proposal which I lay at your feet. I hope that some thinking among you on this subject may encourage the Commission to issue a Notice of Proposed Rulemaking either upon its own motion or in response to a petition filed by an interested party.

After such a notice, I would expect all interested parties to file detailed comments which would help in the ultimate disposition.

R.E.L.

EDITOR'S NOTE: The SY-PEP paper "A Vertical Antenna of Transposed Sections of Coaxial Cable," appearing in the November issue of CH, appeared with the full permission of Communications Products Company and The Institute of Radio Engineers, E. K. Gannett, Managing Editor.

SY-PEP PAPER

(Continued from page 13)

the mobile can reliably talk back.

Combining the effects on the talk-out and talk-back coverage of the undesired base station on the desired system, a plot of the reliable two-way communication coverage is shown in Fig. 8.

The major limitation on the system performance is the effect that the undesired base station transmitter has on the desired base station receiver when the mobile is trying to talk back. The antenna heights and transmitter power advantage that the undesired base station has over the mobile rapidly overcomes the 36 db, or so, difference in power level between the mobile transmitter output and the undesired base station transmitter's modulation sideband energy.

The effects described above will add to the degradation effects from severe signal attenuation, noise, intermodulation, etc. that will be encountered in congested areas, to further degrade those systems operating in such areas.

Conclusion

The Business Radio Service is in dire

need of more channels in many congested areas. Present technical standards do not preclude the use of the 15 kc. tertiary channels to provide the needed relief. However, the modulation sideband products (the elimination or even an appreciable reduction of which is beyond the present state of the art) can severely limit the usefulness and reliability of systems on these new channels, as well as the systems on existing adjacent channels. Geographical separation must be provided between systems on adjacent 15 kc. spaced channels if the reliable talk-back range is not to be degraded severely from what can be expected with the present 30 kc. channel spacing.

The new 13 tertiary channels can be used to relieve the congestion and interference presently existing in the Business Radio Service, but only if proper geographical separation is maintained between adjacent channel users. Further degradation of the service in many areas will be the penalty if their use is not properly planned and controlled.

REFERENCES

1. Federal Communications Commission. Notice of Proposed Rule Making; Docket 13930.
2. Kenneth Bullington, "Radio Propagation at Frequencies Above 30 Megacycles" Proc. I.R.E. Vol. 35 pp. 1122-1136, Oct. 1947.

Editor's Note: Max A. Peckhart, well known in the two-way communications industry, presented this paper at the San Francisco WESCON show August 22, 23, 24, 25, 1961. The views expressed are those of Mr. Peckhart and his employer, the Communications Division of Motorola, Inc., and do not necessarily represent the views of Horizons Publications, or any of its editors.

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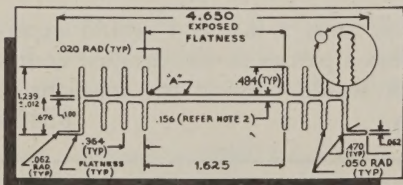
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(Continued from page 1)

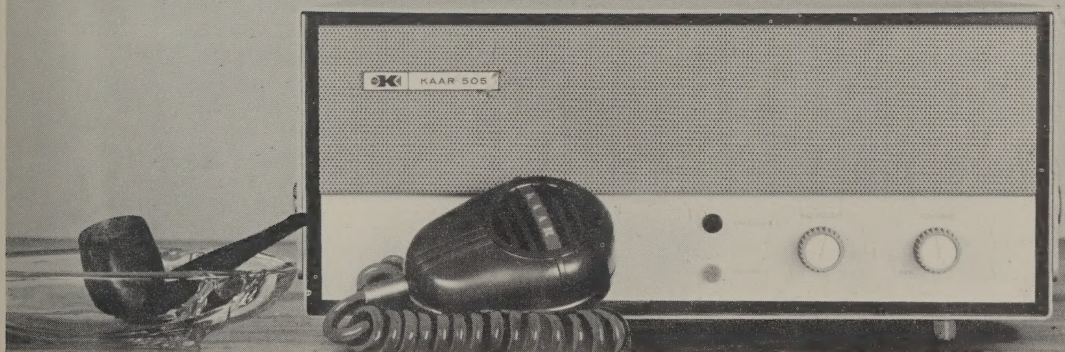
pletely doing away with VHF) can accommodate a growing American economy, and that VHF-UHF or all VHF system cannot, *should* be the overruling factor.

Add to this the fact that until two-way communications acquires additional VHF spectrum space our industry cannot grow to meet the challenge and growth ahead, and you have ample reason to get very-very concerned over Docket 14229.

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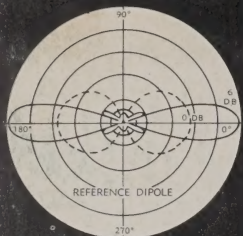
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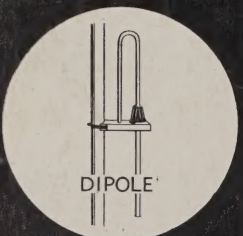
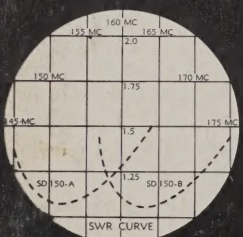




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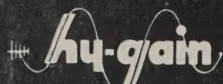


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Overall Length	21 feet
Wind Area	2.2 square feet
Wind Load	70 1/2 pounds at 100 MPH
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ELECTRICAL SPECIFICATIONS

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